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- (52) **U.S. Cl.**
CPC **B32B 38/10** (2013.01); **G06K 19/0723**
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B32B 2519/02 (2013.01); **Y10T 29/49016**
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Y10T 29/5317 (2015.01); **Y10T 29/53174**
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428/24802 (2015.01); **Y10T 428/24917**
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428/2817 (2015.01)
- (56) **References Cited**
- U.S. PATENT DOCUMENTS
- | | | | |
|--------------|------|---------|--------------------------------|
| 3,938,931 | A | 2/1976 | Emmel |
| 4,369,557 | A | 1/1983 | Vandebult |
| 4,664,966 | A | 5/1987 | Bailey et al. |
| 4,717,438 | A | 1/1988 | Benge |
| 4,745,288 | A | 5/1988 | Hurley et al. |
| 4,900,386 | A | 2/1990 | Richter-Jorgensen |
| 5,142,270 | A | 8/1992 | Appalucci |
| 5,161,276 | A | 11/1992 | Hutton et al. |
| 5,434,917 | A | 7/1995 | Naccache et al. |
| 5,566,441 | A * | 10/1996 | Marsh et al. 29/600 |
| 5,645,932 | A | 7/1997 | Uchibori |
| 5,656,115 | A | 8/1997 | Tanno et al. |
| 5,708,419 | A | 1/1998 | Isaacson et al. |
| 5,725,935 | A | 3/1998 | Rajan |
| 5,751,256 | A | 5/1998 | McDonough et al. |
| 5,754,256 | A | 5/1998 | Kim |
| 5,759,422 | A | 6/1998 | Schmelzer et al. |
| 5,800,724 | A | 9/1998 | Habeger et al. |
| 5,861,809 | A | 1/1999 | Eckstein |
| 6,072,383 | A | 6/2000 | Gallagher, III et al. |
| 6,100,804 | A | 8/2000 | Brady et al. |
| 6,147,662 | A | 11/2000 | Grabau et al. |
| 6,161,276 | A | 12/2000 | Droz |
| 6,164,551 | A | 12/2000 | Altwasser |
| 6,191,382 | B1 | 2/2001 | Damikolas |
| 6,259,369 | B1 | 7/2001 | Monico |
| 6,265,977 | B1 | 7/2001 | Vega et al. |
| 6,313,747 | B2 | 11/2001 | Imaichi et al. |
| 6,320,556 | B1 | 11/2001 | Cyman et al. |
| 6,333,721 | B1 | 12/2001 | Altwasser |
| 6,352,497 | B1 | 3/2002 | Hensley et al. |
| 6,353,420 | B1 | 3/2002 | Chung |
| 6,400,323 | B2 | 6/2002 | Tasukawa et al. |
| 6,424,315 | B1 | 7/2002 | Glenn et al. |
| 6,451,154 | B1 | 9/2002 | Grabau et al. |
| 6,466,131 | B1 | 10/2002 | Tuttle et al. |
| 6,476,775 | B1 | 11/2002 | Oberle |
| 6,509,837 | B1 | 1/2003 | Tuttle et al. |
| 6,609,844 | B1 | 8/2003 | Petteruti et al. |
| 6,698,116 | B2 | 3/2004 | Waldron |
| 6,781,508 | B2 | 8/2004 | Tuttle et al. |
| 6,836,215 | B1 | 12/2004 | Laurash et al. |
| 6,839,029 | B2 | 1/2005 | Mendolia et al. |
| 6,933,892 | B2 | 8/2005 | Oberle |
| 6,940,408 | B2 | 9/2005 | Ferguson et al. |
| 6,988,666 | B2 | 1/2006 | Appalucci et al. |
| 7,014,729 | B2 | 3/2006 | Grabau et al. |
| 7,047,624 | B2 | 5/2006 | Vogt |
| 7,116,227 | B2 | 10/2006 | Eckstein et al. |
| 7,176,053 | B1 | 2/2007 | Dimmler |
| 7,224,280 | B2 | 5/2007 | Ferguson et al. |
| 7,250,868 | B2 | 7/2007 | Kurz et al. |
| 7,256,738 | B2 | 8/2007 | Mizukawa et al. |
| 7,283,035 | B2 | 10/2007 | Tuttle et al. |
| 7,284,704 | B2 | 10/2007 | Lubow |
| 7,300,863 | B2 | 11/2007 | Pennaz et al. |
| 7,309,007 | B2 | 12/2007 | Kean |
| 7,345,575 | B2 | 3/2008 | Tuttle et al. |
| 7,374,095 | B2 | 5/2008 | Blank et al. |
| 7,463,150 | B2 | 12/2008 | Rajan |
| 7,477,194 | B2 * | 1/2009 | Coleman et al. 343/700 MS |
| 7,497,004 | B2 | 3/2009 | Cote et al. |
| 7,520,001 | B2 | 4/2009 | Gotoh et al. |
| 7,533,455 | B2 | 5/2009 | Wehr |
| 7,546,671 | B2 | 6/2009 | Finn |
| 7,559,131 | B2 * | 7/2009 | Credelle et al. 29/600 |
| 7,621,451 | B2 | 11/2009 | Berson |
| 7,633,035 | B2 | 12/2009 | Kirmeier |
| 7,641,112 | B2 | 1/2010 | Jensen et al. |
| 7,650,683 | B2 | 1/2010 | Forster et al. |
| 7,681,301 | B2 | 3/2010 | Rodgers |
| 7,836,588 | B2 | 11/2010 | Laksin et al. |
| 7,855,645 | B2 | 12/2010 | Rajan |
| 7,930,815 | B2 * | 4/2011 | Coleman et al. 29/600 |
| 7,997,495 | B2 | 8/2011 | Rodgers |
| 8,033,477 | B2 | 10/2011 | Jones et al. |
| 8,132,734 | B2 | 3/2012 | Lazarowicz et al. |
| 8,202,567 | B2 * | 6/2012 | Kohnle et al. 427/98.4 |
| 2002/0018880 | A1 | 2/2002 | Young |
| 2002/0025416 | A1 | 2/2002 | Uchibori |
| 2003/0051806 | A1 | 3/2003 | Appalucci |
| 2003/0112202 | A1 | 6/2003 | Vogt |
| 2003/0136503 | A1 | 7/2003 | Benoit et al. |
| 2004/0075616 | A1 | 4/2004 | Endo et al. |
| 2004/0078957 | A1 | 4/2004 | Forster et al. |
| 2004/0177492 | A1 | 9/2004 | Eckstein et al. |
| 2004/0221952 | A1 | 11/2004 | Hirschmann et al. |
| 2005/0001785 | A1 | 1/2005 | Ferguson et al. |
| 2005/0035927 | A1 | 2/2005 | Kimura |
| 2005/0089664 | A1 | 4/2005 | Utz |
| 2005/0183817 | A1 | 8/2005 | Eckstein et al. |
| 2005/0197074 | A1 | 9/2005 | Cullen et al. |
| 2005/0198811 | A1 | 9/2005 | Kurz et al. |
| 2005/0206524 | A1 | 9/2005 | Forster et al. |
| 2005/0230486 | A1 | 10/2005 | Halope |
| 2005/0230791 | A1 | 10/2005 | Kanda et al. |
| 2005/0231371 | A1 | 10/2005 | Rowe, Jr. |
| 2005/0274811 | A1 | 12/2005 | Zercher |
| 2005/0284917 | A1 | 12/2005 | Clare et al. |
| 2005/0284941 | A1 | 12/2005 | Lubow |
| 2006/0244662 | A1 | 11/2006 | Bauer |
| 2007/0040686 | A1 | 2/2007 | Reis |
| 2007/0078957 | A1 | 4/2007 | Ypya |
| 2007/0094862 | A1 | 5/2007 | Posamentier |
| 2007/0130754 | A1 | 6/2007 | Fein |
| 2007/0171129 | A1 | 7/2007 | Coleman et al. |
| 2007/0188327 | A1 | 8/2007 | Keeton et al. |
| 2007/0246843 | A1 | 10/2007 | Yang et al. |
| 2008/0047130 | A1 | 2/2008 | Lin et al. |
| 2008/0083706 | A1 | 4/2008 | Kirmeier |
| 2008/0120834 | A1 | 5/2008 | Laksin et al. |
| 2008/0128397 | A1 | 6/2008 | Gandhi |
| 2008/0217309 | A1 | 9/2008 | Rodgers |
| 2009/0230196 | A1 | 9/2009 | Johnson et al. |
| 2010/0071831 | A1 | 3/2010 | Peter et al. |
| 2010/0089535 | A1 | 4/2010 | Hosono et al. |
| 2010/0103238 | A1 | 4/2010 | Neuhard et al. |
| 2011/0220276 | A1 | 9/2011 | Coleman et al. |
| 2012/0060359 | A1 * | 3/2012 | Forster et al. 29/601 |
- FOREIGN PATENT DOCUMENTS
- | | | |
|----|-------------|--------|
| CN | 101 375 463 | 2/2009 |
| CN | 101 541 555 | 9/2009 |
| CN | 101 297 307 | 6/2010 |
| DE | 37 32 825 | 3/1988 |

(56)

References Cited

FOREIGN PATENT DOCUMENTS

DE	200 05 940	8/2000
DE	696 17 753	8/2002
EP	0 665 705	8/1995
JP	2001127410	5/2001
JP	4334704	9/2009
TW	2008/11717	3/2008
WO	01/54058	7/2001
WO	03/024708	3/2003
WO	03/054708	7/2003
WO	03/107266	12/2003
WO	2005/083627	9/2005
WO	2005/089143	9/2005
WO	2007/053355	5/2007
WO	2008148527	12/2008
WO	2009118455	10/2009

OTHER PUBLICATIONS

"Finecut Laser Cutting Systems," Spartanics®, www.spartanics.com, 4 pages, no date shown.

"Fineprint Flatbed Screen Printing Line, Roll-to-Roll," Spartanics®, www.spartanics.com, 2 pages, no date shown.

"Cold Foil for Dummies®," J. Michael Rivera, Wiley Publishing, Inc., copyright 2004.

International Search Report and Written Opinion dated Oct. 6, 2011 for International Application No. PCT/US2011/040379.

International Search Report and Written Opinion dated Oct. 6, 2011 for International Application No. PCT/US2011/040383.

International Search Report and Written Opinion dated Oct. 6, 2011 for International Application No. PCT/US2011/041743.

International Search Report and Written Opinion dated Oct. 6, 2011 for International Application No. PCT/US2011/040391.

Partial European Search Report dated May 16, 2014 for International Application No. EP13005668.

International Search Report dated Sep. 26, 2007 for International Application PCT/US2007/001048 filed Jan. 16, 2007.

Written Opinion dated Mar. 20, 2008 for International Application PCT/US2007/001048 filed Jan. 16, 2007.

International Preliminary Report on Patentability dated May 2, 2011 for International Application PCT/US2007/001048 filed Jan. 16, 2007.

Extended European Search Report dated Feb. 9, 2010 for European Application EP 07 76 2542.

Definition of RFID, Technology.com, printed Mar. 18, 2014, 1 page.

* cited by examiner

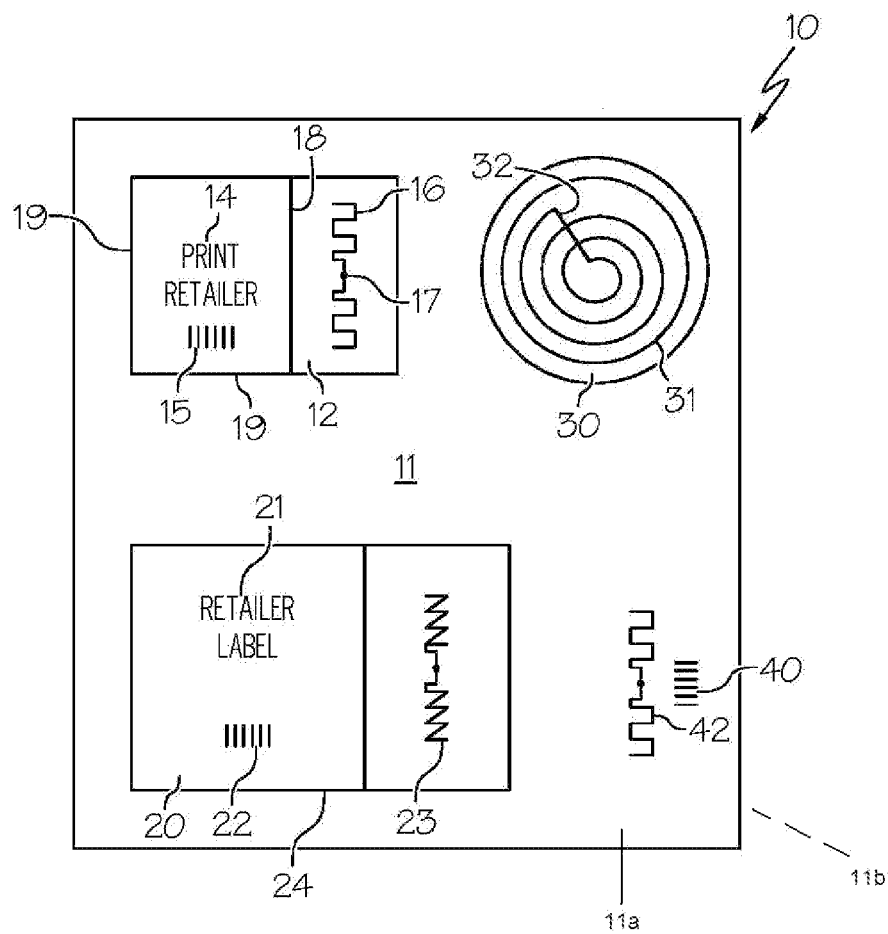


FIG. 1

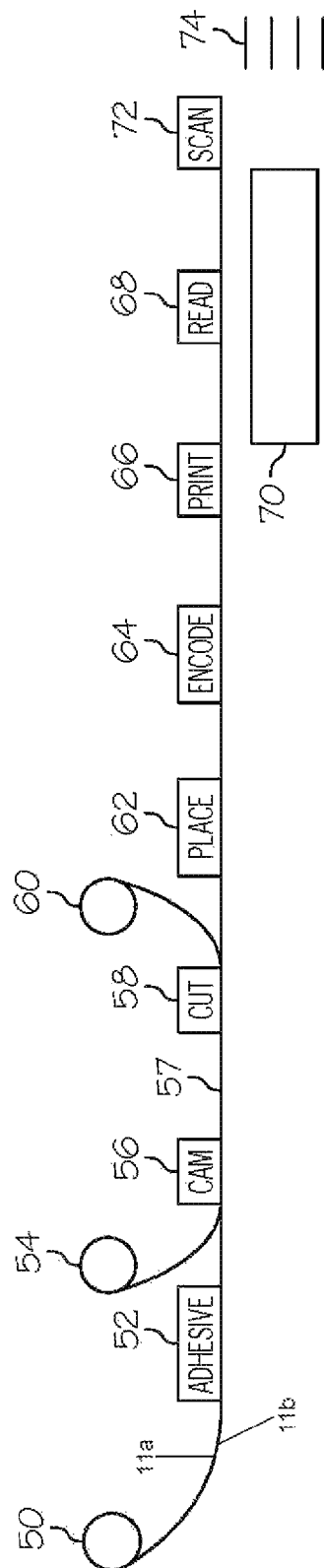


FIG. 2

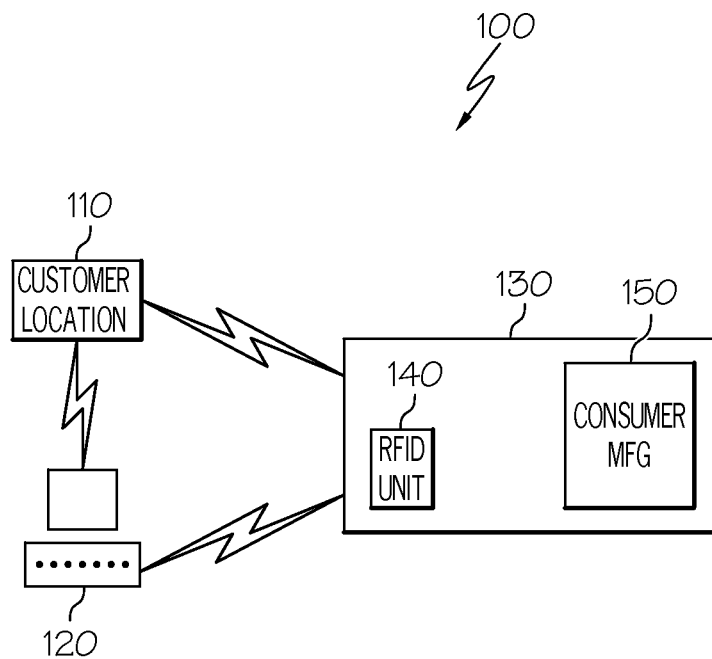


FIG. 3

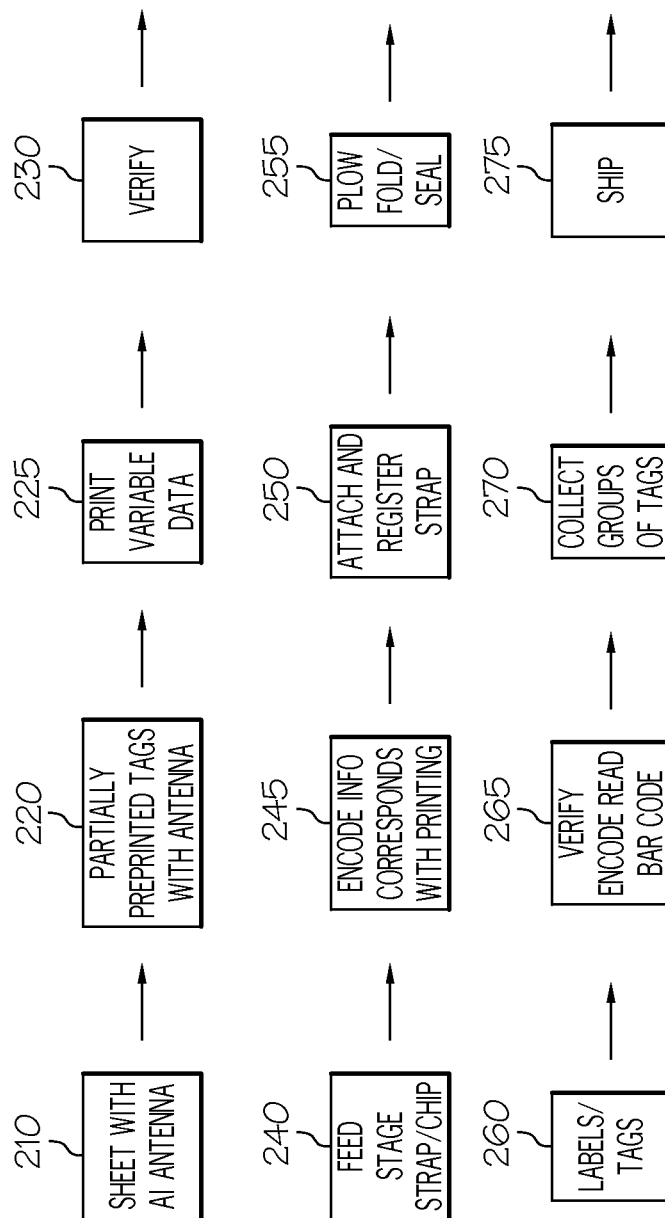


FIG. 4

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METHOD FOR MAKING SHORT RUN RADIO FREQUENCY IDENTIFICATION TAGS AND LABELS

CROSS-REFERENCE TO RELATED APPLICATION

The present application claims the benefit of U.S. Provisional Application Nos. 61/354,380 filed Jun. 14, 2010, 61/354,388 filed Jun. 14, 2010, and 61/354,393 filed Jun. 14, 2010, all of which are incorporated herein by reference in their entireties.

FIELD OF THE INVENTION

The present invention is found in the field of manufacturing radio frequency identification ("RFID") devices. More particularly the present invention relates to a method, system and apparatus for producing RFID tags, labels, tickets, brochures and other printed materials in short production runs.

BACKGROUND OF THE INVENTION

RFID devices can be produced in a number of different methods and commonly include some sort of chip attachment to an antenna which is then used to make an RFID device. The chip can be attached either through the use of a strap or may be applied directly to the antenna. The antenna is a conductive material which may be produced by etching, die cutting or printing of conductive ink on a substrate.

Conductive laminates such as foil laminates are used in a number of applications, ranging from containers for microwave packages to smart cards. Such laminates have regularly been created by die cutting, stamping, and other mechanical processes that generally lend themselves well to high speed situations in which a relatively simple shape or pattern can be created.

The increased demand for circuits has created a need for a manufacturing method that can quickly and efficiently produce such circuits. Once such method is disclosed in U.S. Patent Application No. 2007/0171129 A1. This method includes the steps of providing a reinforced metal foil laminate, having a metal foil layer bonded to a reinforcement layer, and a carrier layer bonded to the metal foil laminate. The method includes the step of using a rotary die cutter to cut an antenna pattern through the metal foil laminate to the carrier layer. The method concludes by removing an undesired matrix portion of the reinforced metal foil laminate to provide a metal foil laminate antenna disposed on the carrier layer.

A rotary die cutter has been used to produce various structures because it is both fast and inexpensive. However, rotary die cutters have poor resolution and are currently limited to having a minimum distance between cut lines of about 1 mm. An additional problem with using a rotary die cutter to cut a construction requiring high precision and tolerance is that the cylindrical die used by the rotary die cutter cannot be quickly or easily changed. Accordingly, the design is not readily changeable, and thus it is often not economically feasible to produce small batches of a particular design because of the need to constantly change out die heads. Furthermore, any change in design would require a large lead-time, as a new cylindrical die must be manufactured each time the design is changed. This can create a large inventory of die heads, the storage of which can occupy valuable factory floor space.

What is needed therefore is a method and apparatus that can produce small batch of RFID devices in a finished format

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that is ready to use and relatively inexpensive so that RFID device manufacturing can be co-located with the manufacturing of consumer goods such as apparel items.

BRIEF SUMMARY OF THE INVENTION

The embodiments of the present invention described below are not intended to be exhaustive or to limit the invention to the precise forms disclosed in the following detailed description. Rather, the embodiments are chosen and described so that others skilled in the art may appreciate and understand the principles and practices of the present invention.

The present invention provides a method, system and apparatus for producing RFID devices in small batches or a short run format and in a collocated environment with a consumer goods production facility.

In one exemplary embodiment of the present invention, a method for producing a ready to use RFID device for consumer goods is described and includes the steps of providing a substrate, with the substrate having first and second faces. Then applying a pattern of adhesive to the first face of the substrate and laminating a conductive foil to the pattern of adhesive. Next, the conductive foil is cut to form to form a plurality of antenna patterns. A chip is applied to each of the antenna patterns. Then, printing is applied on the second face of the substrate to create distinct printed areas. Each of the chips is encoded and placed on each of the antenna patterns. Each of the distinct printed areas is read and the information is matched with each of the distinct printed areas to information encoded in each of the chips. Finally, each of the distinct printed areas are separated from the substrate.

In a still further exemplary embodiment of the present invention, an apparatus for producing a ready to use RFID device for consumer goods is described and includes a supply of material and a supply of conductive material. An adhesive coating station for applying a pattern of adhesive to the supply of material. A laminating station for laminating the supply of conductive material to the pattern of adhesive. A first cutting device for cutting an antenna pattern in the conductive material. A first printing device for printing human and or machine readable indicia on the supply of material. A chip placement device for placing a chip on the antenna pattern to form an RFID device and an encoding station for encoding information on to the chip. The apparatus also includes a computer for comparing the information the encoded information with the human and/or machine readable indicia.

In a yet further embodiment of the present invention, an intermediate assembly of a plurality of ready to use RFID devices for consumer goods is described and includes a substrate that has a plurality of distinct antenna patterns, with each antenna pattern including a conductive foil formed by one of laser cutting or cold foil processing. A pattern of adhesive is coextensive with the antenna pattern and a substrate on which the adhesive pattern and antenna pattern are disposed. A plurality of chips, with each of the chips being encoded with information and each of the chips is connected to one of the plurality of antenna patterns. A plurality of printed areas provided on the substrate, each of the printed areas in association with one of the plurality of antenna patterns forming an RFID device. The printed indicia matches the information encoded on each of the plurality of chips. Each of the RFID devices is removable from the substrate to form a plurality of ready to use RFID devices.

In a still further exemplary embodiment of the present invention, a system for producing ready to use RFID devices is described and includes a manufacturing location for producing consumer goods. A computer for determining types of

consumer goods being produced and for providing instructions for creating and encoding RFID devices for use in association with the consumer goods.

Continuing with a description of the presently described embodiment, an RFID production unit is provided for use with the system, the RFID production unit including a supply of material and a supply of conductive material. An adhesive coating station for providing an adhesive pattern. A laminating station for laminating the conductive material to the adhesive pattern. A cutting station for cutting an antenna pattern to substantially match the adhesive pattern. A chip attaching station for attaching the chip to the antenna pattern. A printing station for printing human and or machine readable indicia on the supply of material. A reader for reading information encoded on the chip and for matching the information to the human and or machine readable indicia. The RFID production unit and manufacturing location are collocated with one another.

Other features and advantages of the present invention will become apparent to those skilled in the art from the following detailed description. It is to be understood, however, that the detailed description of the various embodiments and specific examples, while indicating preferred and other embodiments of the present invention, are given by way of illustration and not limitation. Many changes and modifications within the scope of the present invention may be made without departing from the spirit thereof, and the invention includes all such modifications.

BRIEF DESCRIPTION OF THE DRAWINGS

These, as well as other objects and advantages of this invention, will be more completely understood and appreciated by referring to the following more detailed description of the presently preferred exemplary embodiments of the invention in conjunction with the accompanying drawings, of which:

FIG. 1 depicts a front view of an exemplary intermediate assembly produced in accordance with the method and system of the present invention;

FIG. 2 provides a schematic of an exemplary apparatus used in connection with practicing the present invention;

FIG. 3 shows a schematic of an exemplary system used in connection with practicing the present invention; and

FIG. 4 illustrates a block diagram setting forth an exemplary method of practicing the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The apparatuses and methods disclosed in this document are described in detail by way of examples and with reference to the figures. Unless otherwise specified, like numbers in the figures indicate references to the same, similar, or corresponding elements throughout the figures. It will be appreciated that modifications to disclosed and described examples, arrangements, configurations, components, elements, apparatuses, methods, materials, etc. can be made and may be desired for a specific application. In this disclosure, any identification of specific shapes, materials, techniques, arrangements, etc. are either related to a specific example presented or are merely a general description of such a shape, material, technique, arrangement, etc. Identifications of specific details or examples are not intended to be, and should not be, construed as mandatory or limiting unless specifically designated as such. Selected examples of apparatuses and methods are hereinafter disclosed and described in detail with reference made to FIGURES.

The present invention provides for the production of small batches of RFID devices, that can be produced in short runs, production runs ranging from one RFID device to perhaps a thousand separate units. The method, apparatus and system of the present invention can be used to create a plurality of individual RFID devices that can either change device configuration from device to device or may produce a specific number of a particular unit, then change configurations to complete a particular order requested by an end user. For example, a customer may request fifty units of a first type of RFID device and then 100 units of a second type of RFID device.

Reference is now directed to FIG. 1 of the present invention which shows an intermediate 10. As used herein, the term intermediate refers to a product that undergoes one or more processing steps in order to provide a finished product. For example with reference to the current FIG. 1, a plurality of discrete or distinct printed areas 12, 20 and 30 that include RFID devices are provided on a sheet 11 which may subsequently be severed or otherwise removed from the sheet. Certain RFID devices, such as 20 which is a label, may have an adhesive coating (not shown) applied prior to being used. RFID device 12 may undergo a folding step along fold line 18 and then an attaching step to connect the device 12 to a consumer good.

The discrete or distinct printed areas distinct printed areas 12, 20 and 30 are selected from a group including tags, labels, hang tags, badges, shelf talkers, flyers, brochures, marketing collateral, tickets, cards and combinations thereof.

Sheet 11 has a front face which is shown in FIG. 1 and a rear face which is not shown. The sheet 11 is provided with indicia and in this example includes machine readable information 40 and an RFID device 42. The indicia 40 and RFID device 42 can be used to help track a particular job or production order or to provide instructions to the apparatus to produce the particular order being contemplated. The code and RFID device can be read by machine such as a bar code scanner or RFID reader.

The intermediate 10, still referring to FIG. 1, as previously indicated includes the sheet 11 having a first face 11a and a second face 11b, and several distinct printed areas 12, 20 and 30 to be used for a particular application. First area, or hang tag intermediate 12 in this example, shows human readable indicia 14 and machine readable indicia 15 (bar code) on a first side and a RFID antenna 16 and chip 17 on the second side. The human and machine readable indicia as shown may relate to retailer information, brand information, pricing or any information that the particular customer requires. The two sides are separated by a fold line 18. Tag 12 is held to the sheet 11 by a series of ties 19 which are created when the sheet 11 is perforated around the perimeter of the tag. The perforations 19 are shown extending around the perimeter and can be easily broken so as to separate the tag 12 from the sheet 11 and then subject to further processing, e.g. folding and attaching to a consumer good.

The next distinct printed area 20 shown in FIG. 1 is depicted as a label intermediate. The label intermediate 20, again has human readable indicia 21 and machine readable indicia 22 which again can relate to any information that has been requested by the customer for whom the order is being created. The label intermediate 20 also has an RFID device 23. It should be pointed out that the RFID device 23 of label intermediate 20 is different than the RFID device 16/17 of hang tag intermediate 12 further illustrating the flexibility of the present invention. That is, one intermediate assembly can have a first RFID device design and another intermediate assembly can have a different RFID device design.

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The label intermediate **20** is also held in place in the sheet **11** by a series of ties **24** which again allow for the label intermediate **20** to be readily and easily separated from the sheet **11** when required for use or further processing.

The final intermediate assembly **30** shown on sheet **11** of FIG. **1**, provides a high frequency (HF) RFID label. This is further distinct from the RFID devices shown in connection with distinct printed areas **12** and **20**, which for example may be ultra high frequency labels (UHF). The HF device includes a plurality of coil windings **31** and a chip/bridge **32** connecting each end of the coil to complete the circuit.

Reference is now directed to FIG. **2** of the presently described invention. The schematic starts with a supply of material **50**. The supply of material **50** may be selected from one of paper, woven fabric, non-woven fabric or plastic. While the supply of material **50** has been depicted as a continuous roll of material, it should be understood that the supply may consist of one or more pre-cut sheets and, the invention may be practiced in a sheet feed configuration.

The supply of material or web **50** is fed to an adhesive applicator **52**. The adhesive, which may be a pressure sensitive or other suitable adhesive, can be applied in a pattern that will be in the shape or form of the antenna used for the RFID device that will be formed as seen in connection with FIG. **1** of the intermediate sheet or may be full or flood coated on to the supply **50** which will then later undergo a curing process to create tacky and non-tacky areas, with the tacky areas corresponding to the antenna patterns that are to be created. The curing can be done by UV energy or other suitable process.

The present invention contemplates that the adhesive may include optical brighteners. In a preferred embodiment, the optical brighteners are a fluorescent powder that is approximately 1% by weight of the adhesive and more preferably about 0.5% by weight of the adhesive. Other triggers or signals can be used to initiate the laser and register the patterns to be formed in the web such as cuts or slits in the web, taggant inks, printing inks and the like.

The optical brighteners may be provided in the area where the cutting of at least one pattern for a foil or conductive laminate is to occur in the foil laminate layer. The optical brighteners may be printed on top of the adhesive layer rather than mixed within the adhesive layer. Additionally, it is contemplated by the present invention that the optical brighteners may be printed on top of the substrate as opposed to mixed or on top of the adhesive layer. In this embodiment, it is preferred that the adhesive layer is clear or transparent so that the optical brighteners may be seen through the adhesive layer.

Additionally, in one embodiment of the present invention, optical brighteners may be printed in the shape of the foil or conductive laminates that are going to be constructed out of the foil or conductive layer or material.

Next, a supply of conductive material **54**, such as a foil, alloy or conductive ink on a transfer sheet is passed to be in juxtaposition with the first supply **50**. The conductive material **54** is then laminated in part to the supply **50** by laminating station **56**. The partial lamination occurs only in the areas of the adhesive pattern or the tacky portions of the adhesive pattern. As the foil is not fully laminated to the web, the foil creates a 100% fully recyclable material when removed as the foil is not contaminated with adhesive or has portions of the substrate connected to the foil.

Continuing with a discussion of FIG. **2**, the combined web **57** is then fed to a cutting or antenna forming station **58**. The cutting or forming may be accomplished by one of die cutting, laser cutting or cold foil processing. The cutting or forming station may also have multiple elements, such as a

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first die cutting or cold foil process and then laser cutting. As used herein an exemplary cold foil process refers to printing an adhesive or other curable pattern onto a substrate then applying a foil layer over the pattern, laminating the foil to the pattern so that the foil sticks to the pattern and then stripping away the foil, leaving the pattern on the substrate covered with the foil layer.

Once the antenna pattern is formed by the cutting forming station **58**, the remaining matrix of material is rewound at station **60**. The now partially laminated web **57**, partially laminated as it has the conductive patterns of material adhered to the supply **50**, but the remaining amount of material has been removed. The web **57** then moves the chip or strap placement station **62** where a chip or strap is placed on the antenna to complete the assembly of the RFID device. Next, the RFID device (chip or strap) is encoded at station **64** with information relating to the product to which the discrete printed area (see FIG. **1**) is to be associated (attached, adhered, etc.)

Continuing with a discussion of FIG. **2**, the web **57** then travels to a printing station **66** where human and/or machine readable indicia is provided on the web (see FIG. **1**). The indicia is printed in each of the discrete areas and may also be printed on the margins of the web. Once the printing is complete, the encoded RFID devices and indicia are read and/or scanned, respectively at station **68**. In the event that the reading/scanning reveals that the information encoded on the RFID device and printed indicia do not match, the discrete printed area is discarded into discard area **70**. This may be accomplished by punching out the discrete printed area such as by a rotary punch, plunger or other suitable device. The remaining web **57** having one or more discrete areas where the encoding and the printed indicia match, is then passed to a separation station **72**. Each of the discrete areas are then collected at station **74** and may then be shipped or otherwise delivered to the end user that requested the particular order.

Turning now to FIG. **3** an exemplary system for use in procuring products in connection with the present invention is presented and is referenced generally by numeral **100**. The system **100** includes a first location **110**, such as a customer location, which may be a company headquarters, distribution or procurement location or other site where ordering and processing products is performed. The first location **110** is connected via a global communications network **120** to a second location **130**, which may include for example assets for producing consumer products **150** and an RFID production unit **140**. Ideally, both the RFID production unit **140** and the consumer products manufacturing assets **150** are collocated, but it should be understood that the two units **140** and **150** may be at distinct physical locations but connected by a communications systems to allow the units to easily and readily communicate with one another.

The system **100** of the present invention will start with an order for consumer goods or other products emanating from the first location or customer location **110**. The order will be sent the global communications network **120** to the second location **130** that houses, in this example, both the RFID production unit **140** and the assets **150** that are used in the manufacturing the product that is the subject of the order generated by the first location **110**.

The order will be received by the second location **130** which will commence a sequence of generation of intermediates as provided in FIG. **1**, as well as the production of consumer goods or other products. As the consumer goods or products are created by the manufacturing assets **150** and are collected, the discrete printed areas of FIG. **1** are separated and attached to the consumer goods or other products. The

attachment includes the removal of each of the discrete printed areas that are held by ties as discussed above in the sheet of the intermediate, and then connected to the consumer goods such as by adhering, affixing, or otherwise attaching. Once the tags are associated with the consumer goods, the goods can then be shipped to the first location 110 or to another location that has been designated in the order that initiated the sequence.

Reference is now directed to FIG. 4 in which a block diagram showing an exemplary method of producing a finished RFID device or intermediate (as shown in FIG. 1) is provided. The process commences for example at step 210 in which a supply of material is provided. It should be understood that the supply of material can be provided in either a continuous format, such as a roll of material, or in a cut sheet format, where a stack of sheets are provided to the apparatus to provide the supply. The supply of material may have a plurality of antennas for use in forming the RFID devices. The antennas that are provided may have a generic pattern that will need to be further cut or modified in order to produce the final antenna pattern that is sought. Alternatively, a supply of blank material can be provided and conductive material then subsequently adhered and attached to the substrate to make the antenna supply.

Where the supply of material is provided with a first antenna structure of a particular format that antenna structure can be further modified such as by cutting with a laser cutter or mechanical die cutter. In this manner, a large pre-formed stock can be created that can be tailored to meet a number of applications thereby meeting the needs of a large number of customer applications. For example, the assembly created using the apparatus of FIG. 2 can be fed into the process of FIG. 4 and further modified as described above by laser cutting.

It should be understood, that FIG. 4 provides for the processing of a particular supply of material and that the apparatus used in connection with the forming of the intermediates, including the steps of applying an adhesive, creating a pattern, laminating a foil layer to the adhesive pattern, cutting of the pattern and other associated steps are intended to be included in the present method and that for the sake of brevity the steps are not necessarily repeated herein.

Next, at step 220 a first printing of fixed indicia can occur. For example, this printing can include such things as the name of the retailer, or other information that does not change from tag to tag. At step 225, variable information is provided to the material. The variable information may for example be a size, color, price or such other information that may change from tag to tag. Next, the information contained in the variable information 230 is verified by scanning, or other reading of the information. The information can be both human and machine readable indicia.

The printing that is provided can be accomplished by any number of suitable printing methods, such as non-impact, e.g. ink jet, ion deposition, laser printing, impact printing, thermal transfer or such other process as may be requested by the consumer or may lend itself to the production of intermediates and tags/labels as required herein.

At step 240, RFID chips which may also be provided in a strap configuration are fed to the supply of material. Then each of the chips or chips with straps are encoded at step 245 with information that corresponds to the variably printed information and, when required also the fixed information provided earlier in the process. That is, as each discrete portion of the supply as shown in FIG. 1 is provided with unique

indicia, the chips are also encoded with unique indicia relating to the products with which the RFID chips are to be associated.

Once the chips have been encoded at step 240, the chips or chips in a strap format are provided to the supply of material and attached at step 250. The chips/straps are attached in registry with the chip attachment point of the antenna.

Next, for example when hang tags are being created, the supply of material is plow folded or sealed at step 255. That is, with respect to plow folding, one panel is folded over on top of the other so as to create a closure assembly. Alternatively, if a label arrangement is provided, an adhesive may be applied to the web and sealed to the web. The adhesive may be applied as part of a transfer tape construction, adhesive and liner. In a transfer tape configuration, the adhesive will have a greater affinity for the supply of material as opposed to the liner such that the adhesive will remain with the supply of material and not the liner when the adhesive is needed for use.

The final format of the discrete areas to be created is done at step 260, and an area around the RFID device and printing is created to facilitate separation later as shown in FIG. 1. At step 265 the encoding of the RFID chips and printing is verified to ensure that the RFID chips and printing correspond to one another. If there is no match between the encoded information on the chips and the information printed on the tags, the tags or discrete printed areas can be removed from the supply of material or alternatively can be marked so show that the tag is defective so that it will not be used at a later time.

Next, at step 270 the discrete printed areas or now tags or labels are collected so that they can be shipped or delivered at step 275 to the manufacturing location where the consumer goods and the RFID production device are located.

It will thus be seen according to the present invention a highly advantageous method, system and apparatus has been provided. While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it will be apparent to those of ordinary skill in the art that the invention is not to be limited to the disclosed embodiment, and that many modifications and equivalent arrangements may be made thereof within the scope of the invention, which scope is to be accorded the broadest interpretation of the appended claims so as to encompass all equivalent structures and products.

The inventors hereby state their intent to rely on the Doctrine of Equivalents to determine and assess the reasonably fair scope of their invention as it pertains to any apparatus, system, method or article not materially departing from but outside the literal scope of the invention as set out in the following claims.

What is claimed is:

1. A method for producing a ready to use RFID device for consumer goods, comprising;
 - providing a substrate, the substrate having first and second faces;
 - applying a pattern of adhesive to the first face of the substrate;
 - laminating a conductive foil to the pattern of adhesive;
 - cutting the conductive foil to form to form a plurality of antenna patterns;
 - applying a chip of plurality chips to each of the antenna patterns;
 - printing on the second face of the substrate to create distinct printed areas;
 - encoding each of the chips and placing each of the chips on each of the antenna patterns;
 - reading information of each of the distinct printed areas;

matching information of each of the distinct printed areas to information encoded in each of the chips; and separating each of the distinct printed areas from the substrate.

2. The method of claim 1, including a further step of punching out distinct printed areas where the information of each of the printed areas does not match the encoded information after the step of matching. 5

3. The method of claim 1, wherein the step of printing includes machine and human readable indicia. 10

4. The method of claim 1, wherein the step of cutting is conducted by one of laser cutting or cold foil processing.

5. The method of claim 1, including a further step of creating a plurality of second antenna patterns after the step of cutting the conductive layer. 15

6. The method of claim 1, wherein the step of printing is accomplished by one of ink jet printing, laser, non-impact printing or a combination thereof.

7. The method of claim 1, including a further step of printing a conductive pattern on the substrate after the step of cutting. 20

8. The method of claim 1, including a further step of collecting each of the distinct printed areas for an order after the step of separating.

9. The method of claim 1, wherein the distinct printed areas are selected from a group including tags, labels, hang tags, badges, shelf talkers, flyers, brochures, marketing collateral; tickets, cards and combinations thereof. 25

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